

supernatant liquid perfectly clear. They are then filtered through separate funnels, and washed with hot water. No. 1 is dried and weighed. No. 2 is digested in bromide of potassium, dried and weighed; and No. 3 in iodide of potassium, dried and weighed.

To test the method, a mixture was made of 5 grains of iodide of potassium, 5 grains of bromide of potassium, and 5 grains of chloride of sodium. The following is a comparison of the theoretical and experimental results:—

|                | EXPERIMENT. |       | THEORY. |
|----------------|-------------|-------|---------|
| Iodine .....   | 3·69        | ..... | 3·81    |
| Bromine .....  | 3·51        | ..... | 3·34    |
| Chlorine ..... | 2·92        | ..... | 3·02    |

I have availed myself of this method in analysing several silver ores containing chloride, bromide and iodide of silver found in Chili, the formulæ of which I subjoin:—

|                               |                 |
|-------------------------------|-----------------|
| Chloride of silver .....      | Ag Cl.          |
| Chlorobromide of silver ..... | 2Ag Cl, Ag Br.  |
| Chlorobromide of silver ..... | 3Ag Cl, 2Ag Br. |
| Chlorobromide of silver ..... | Ag Cl, 3Ag Br.  |
| Bromide of silver.....        | Ag Br.          |
| Iodide of silver .....        | Ag I.           |

V. "Note on the Density of Ozone." By THOMAS ANDREWS, M.D., F.R.S., Vice-President of Queen's College, Belfast, and P. G. TAIT, M.A., Fellow of St. Peter's College, Cambridge, and Professor of Mathematics in Queen's College, Belfast. Received June 17, 1857.

It is known that Ozone can only be obtained mixed with a large excess of oxygen. In a former communication by one of the authors of this note, it was shown that in the electrolysis of a mixture of 8 parts of water and 1 of sulphuric acid, the mean quantity of Ozone does not exceed ·0041 gramme in a litre of oxygen, or  $\frac{1}{36}$ th part. By using a mixture of equal volumes of acid and water, the relative quantity of Ozone may be doubled; but even with the Ozone in this

more concentrated state, the ordinary methods of determining the density of a gas are plainly inapplicable. The difficulty of the problem was farther increased by the rapid action of Ozone on mercury, which rendered it impossible to collect or measure the gas over that metal; and the tension of aqueous vapour, as well as the gradual destruction of Ozone by water, prevented the use of the latter. After numerous trials, the method finally employed was to measure the change of volume which occurs in exposing a gaseous mixture containing Ozone to a temperature of  $230^{\circ}\text{C}.$ , or upwards. The volume of the gas after this treatment was invariably found to have increased; and by eliminating the effects of alteration of temperature and pressure during the course of the experiment, by the aid of a similar vessel to that containing the Ozone, the authors succeeded in estimating the change of volume which took place, to an extremely small fraction of the entire amount.

The vessels employed in different experiments varied in capacity from 200 CC. to 600 CC., and terminated in tubes of about 2 millimetres in diameter, bent in a U-form and containing sulphuric acid. The amount of Ozone was ascertained by passing a stream of the gas through two other vessels, one placed on each side of the vessel to be heated, and afterwards analysing their contents by the method described in the communication already referred to. It was easy to measure with certainty a change of pressure amounting to  $\frac{1}{60,000}$ th of the whole; but on account of the ordinary fluctuations of atmospheric pressure between two consecutive observations of the primary and auxiliary vessels, it was rarely possible to work to this degree of accuracy.

The experimental data have not yet been completely reduced, and some slight corrections have yet to be investigated; but the general result of the inquiry, which has been a very protracted one, gives—on the assumption that Ozone is oxygen in an allotropic condition—for its density as compared with that of oxygen, nearly the ratio of 4 to 1.

The following approximate formulæ were employed in the reduction of the experiments. They are sufficiently exact for the purpose of calculation on account of the smallness of the quantities observed.

I. To reduce the change of level observed in the auxiliary vessel

during the interval of the experiment to the equivalent quantity for the primary vessel—

$$\left(\frac{2}{a} + \frac{1}{H}\right) \delta x = \left(\frac{2}{a} + \frac{1}{H_p}\right) \delta x_p.$$

II. To deduce from the corrected change of level in the primary vessel the relative density of Ozone and oxygen—

$$\frac{e-1}{e} = m \left(\frac{2}{a} + \frac{1}{H}\right) \delta x_{II}.$$

In these formulæ

$a$  is the barometric pressure in terms of the sulphuric acid in the U-tubes.

$H$ , the length of a tube of the same diameter as the U-tube of the primary vessel, and whose capacity is equal to that of the same vessel measured to the mean level of the acid in the U-tube.

$H_p$ , the same quantity for the auxiliary vessel.

$\delta x_p$ , one-half of the change in the difference of levels in the U-tube of auxiliary vessel.

$\delta x$ , the corresponding quantity for the primary vessel.

$\delta x_{II}$ , half the observed change in the primary vessel corrected by the quantity  $\delta x$ .

$m$ , the ratio of the weights of oxygen and Ozone in the gaseous mixture.

$e$ , the relative density of Ozone and oxygen.

VI. "Contributions towards the History of the Phosphorus-, Arsenic-, and Antimony-Bases." By A. W. HOFMANN, Ph.D., LL.D., F.R.S. Received June 18, 1857.

The facility with which the phosphorus-bases can be obtained by the action of zincethyl upon terchloride of phosphorus, has induced me to study the action of this agent upon the terchlorides of arsenic and antimony. I have found that triethylarsine and triethylstibine, hitherto obtainable only with difficulty, by submitting the alloys of